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AUTHOR Marzano, Robert J.; And Others
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ABSTRACT

Do variables identified as existing within effective school models relate causally to student achievement? A study attempted to answer this question by manipulating selected school effectiveness variables and teacher behavior and by examining the effects of that manipulation on student achievement. Over a 1-year period, 10 kindergarten through fourth grade teachers from 2 small rural elementary schools received 20 days of training in the theory and implementation of 8 school effectiveness variables. Ethnographic observational techniques conducted before and after training established that some positive changes occurred in school climate and that teachers used less time than they had used previously in managerial activities and more time explaining the goals for lessons and activities. Teachers also used more managerial and motivational techniques. Observations and classwork for the teachers' 141 students showed that, following teacher training, students had less allocated time for reading and math but that they were more engaged and more successful in classwork. A decrease in math and reading achievement was indicated on standardized tests. It was suggested that participating teachers' emphasis on systematizing instruction and simplifying content had the effect of increasing academic learning time, as it is currently defined, but that these changes did not help students acquire independent thinking and problem solving-skills--skills necessary for performing well on standardized achievement tests. (CB)

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A STUDY OF SELECTED SCHOOL EFFECTIVENESS VARIABLES: SOME CORRELATES THAT ARE NOT CAUSES

by

Robert J. Marzano, Ph.D.

Barbara J. Guzzetti, Ph.D.

C.L. Hutchins, Ph.D.

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INTRODUCTION

The late Ron Edmonds stated that a major research agenda facing education is to determe whether the correlates of school effectiveness are also the causes (Edmonds, 1982). The question is: do various variables identified within the many current effective school models (e.g., Berliner, 1984; Hosford, 1984; Fisher et al., 1980) have a causal relationship with achievement? In this paper we discuss the results of a study that attempted to answer that question by manipulating selected school effectiveness variables, changing teacher behavior and studying the effects of that manipulation on student achievement.

This study is more important for what it did not find than for what it did find. In general, change in behavior relative to the school effectiveness variables was not accompanied by a concomitant positive change in student achievement. In fact, the general trend was decreased achievement. Given the current proliferation of programs which focus on many of the same variables purporting to have positive effects on student achievement (Raiche, 1983), these findings raise a pertinent question - chiefly: "What is the nature of the relationship between school effectiveness variables and achievement?"

Given that our findings are not a function of possible threats to validity raised by the study's quasi-experimental nature, some strong recommendations can be made for future research. In this article we discuss procedures and findings of the study, and resulting implications.

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REVIEW OF THE LITERATURE: SCHOOL EFFECTIVENESS VARIABLES

Even a cursory review of the literature indicates that there are many variables associated with school effectiveness and many ways of grouping those variables. Edmonds, (1982) based on his own work and that of other researchers such as Mayeske et al. (1972), Weber (1971), Averch et al. (1974), Brophy and Good (1970) and Brookover et al. (1979), listed five ingredients of effective schools: 1) strong leadership by administrators, 2) high expectations, 3) safe and orderly atmosphere, 4) emphasis on basic skills, and 5) frequent monitoring of student progress. Mann (1983), using a Delphi technique, identified and ordered six variables: 1)teacher characteristics and behavior, 2) administrator characteristics and behavior, 3) student body composition, 4) school learning climate, 5) pupil evaluation procedures, 6) curriculum materials. Westbrook (1982) lists ten: 1) time on task, 2) expectations, 3) success rate, 4) curriculum alignment, 5) staff task orientation, 6) behavior management, 7) school environment, 8) instructional leadership, 9) cooperative parent participation, and 10) instructional practices.

For this study eight independent variables were selected: 1) building leadership and support to teachers, 2) staff collegiality and collaborative planning, 3) staff expectations for students, 4) teacher use of time, 5) teacher use of efficient managerial techniques, 6) teacher use of motivational techniques, 7) student time on task, and 8) student success. For discussion purposes, variables 1-3 were organized under the general heading "school climate variables"; variables 4, 5 and 6 under the heading "instructional techniques" and variables 7 and 8 under the general heading "mediating student outcomes." Such an organization is consistent with the general

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categories suggested by Purkey & Smith (1982). Below we briefly consider the theoretical and research basis for each variable.

Leadership and Support to Teachers

There are a number of studies which make it clear that leadership is necessary to maintain any improvement process (Weber, 1971; Armor et al., 1976). Commonly, support is translated into staff development (Venesky & Winfield, 1979). Leadership is generally operationalized into a set of administrator behaviors. Below is a sample of the behaviors selected for this study:

- o Teachers' personal concerns solicited by the principal
- o The principal's availability to discuss teachers' problems
- o the principal's awareness of problems within the building

Staff Collegiality and Collaborative Planning

Purkey and Smith (1982) report that collegiality serves many purposes: it breaks down barriers between departments and among teachers and administrators; it encourages the kind of intellectual sharing that can lead to consensus, and it promotes feelings of unity (Little, 1981; Hargrove et al., 1981). From the literature a set of specific behaviors which purportedly indicate an atmosphere of collegiality and collaborative planning were selected for study. They included:

- o cross-grade coordination of instruction in the school
- o teachers' opportunities to learn what and how other teachers teach
- o faculty members' awareness of each other's interests and special abilities

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Staff Expectations for Students

There is a growing body of research supporting the contention that high expectations commonly shared by staff positively effects student achievement (Beattie & Olley, 1977; McCarthy, 1977; Brookover et al., 1979; Armor et al., 1976). For this study, specific school-wide behaviors were identified which indicate high expectations for all students. Those behaviors included:

- o grouping arrangements that are not used to signal negative or low expectations to some students
- o teacher praise that is realistic and specific
- o uniform standards held for all students

Teacher Use of Time

One of the primary findings in the Beginning Teacher Evaluation Study (Fisher et al., 1980) was that teachers used their instructional time differently and that this differential use has a relationship with student achievement. Specifically, teacher practices that resulted in lesser amounts of time spent on non-instructional activity was associated with higher achievement gains. This finding has been incorporated into a number of models of effective instruction (Berliner, 1984; Hosford, 1984; Magnuson-Martinson & Barner, 1983). In this investigation, eight types of non-instructional classroom behaviors were selected for study: beginning managerial time, transition time, time teachers spent giving assignments, time teachers spent disciplining, time teachers spent working with individual students while others wait, ending managerial time, and time lost to social activities and interruptions.

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Teacher Use of Managerial Techniques

The specific areas of managerial techniques selected for this study were: clarity of classroom or school rules and procedures, and clarity of instructional goals and assignments. Evertson (1980) found the extent to which teachers explained, modeled and reinforced classroom rules and procedures was associated with increased achievement. Descriptions of how the effectively run classroom is managed relative to rules and procedures have been offered by Brophy (1982).

The clarity with which instructional goals have been communicated to students has also been related to achievement gains (Tikunoff et al., 1975; Fisher et al., 1980; Bruner, 1981; Berliner, 1983). The specific teacher behaviors relative to the clarity of rules, procedures, goals and assignments identified for this study include:

Clarity of Rules/Procedures
- -teacher has a workable and consistent routine and policy for enforcement of school-wide policies or rules
- -teacher holds students accountable for keeping rules
- -teacher has a visual list of rules - clearly defined in writing or symbols

Clarity of Goals/Assignments
- -teacher alerts students to the objective of the lesson
- -teacher gives clear specific feedback about students' questions
- -teacher gives directions often and spends time discussing the structure of the lesson

Teacher Use of Motivational Techniques

Maehr (1970), Ramberan (1977) and Hutchins (1981) each cite specific motivational techniques to be used by teachers which affect student achievement. For this study, seven teacher behaviors relative to motivation were selected from the sources above. Those behaviors include:

- o the teacher provides learning activities of variety and wide range of intellectual challenge

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- the teacher has a special means to recognize and reward students who have made progress

Student Time on Task

The Beginning Teacher Evaluation Study (BTES) was perhaps the first to popularize the importance of student engagement relative to achievement. However, Bloom (1974) cited studies by his students (Anderson, 1973; Arlin, 1973; Ozcelik, 1973) that were concerned with the extent of time students are engaged or involved in "active learning". In a review of the BTES, Borg (1980) reported a significant partial correlation between engaged time and student gain in achievement when post-achievement was regressed on pre-achievement and engaged time. In this investigation, student engagement rate and engaged time were studied. Engaged time was defined as the total amount of time within a day that students are on task. Engagement rate was considered the proportion of time students are on task within the total amount of instructional time.

Student Success

Engaged time is reported to account for a limited amount of the residual variance for achievement gain for a few reading/mathematics subskills; however, academic learning time (ALT) is reported to have a stronger relationship with more academic areas (Borg, 1980). Rosenshine (1983) has reviewed a number of studies, finding that during initial stages of learning, success rate should be relatively high. Brophy (1983) asserts that in independent seat work assignments the need for high success rates is particularly important. In this investigation, success rate and academic learning time were studied. Success rate was defined as the average rate of success for students as

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measured by performance in homework, quizzes and responses. ALT was defined as the proportion of engaged time students spend within specific success rate ranges as defined by Berliner (1984).

METHOD

Procedures

Ten teachers, five from each of two schools, participated in the study. Four grade levels were represented - two teachers per grade level. Both schools are small, rural institutions; both had been operating on a four-day school week two years prior to the beginning of the project. A total of 141 students participated in the study.

Over a period of one year the participating teachers received 20 days of training in the theory and implementation of the eight selected school effectiveness variables. Following the suggestions of Schienfeld (1979) and Berman and Parly (1975), participating teachers were given decision-making power in the planning and format of the training sessions. Based on suggestions by Charters and Pelligrin (1972) participants were given systematic feedback regarding implementation of instructional and organizational techniques. Each training session usually consisted of one day of theory and one day of practice; participating teachers had the opportunity to practice and receive feedback from the trainers on the techniques presented within the training sessions. This process is consistent with the model of effective teacher inservice suggested by Joyce and Showers (1982).

DATA COLLECTION ANALYSIS

Baseline data were collected in the spring of 1982. Data for the school climate/culture variables was collected by using ethnographic

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techniques. A trained observer sought out examples of specific behaviors identified for each of the climate/culture variables; rather than simply record the quantity of such behaviors, anecdotal notes were taken. Data relative to the instructional variables and mediating student variables were collected by direct classroom observation. Observers "shadowed" each teacher for an entire day, recording the engagement and success of students, actual allocated time for reading and mathematics, use of non-instructional time, and the quantity of specific behaviors for teacher use of motivational and managerial techniques. Each teacher was observed for three days for baseline data collection and for eight days for post-intervention data collection. Pre- and post-achievement data (reading and mathematics) from the Iowa Test of Basic Skills was also collected. The unit of analysis for the study of instructional variables was the classroom; the unit of analysis for the study of school climate/ culture variables was the school. Therefore, there were only ten and sometimes two data points with which to answer any given research question. Rather than aggregate the data into one analysis (e.g., regressing change in student achievement on change for any or all of the eight selected variables) each variable was analyzed in isolation and then all results were interpreted as a whole. The design did not allow us to study the inter-relationship among variables in a statistical sense. Rather, we studied the change for each of the selected variables and then studied the overall pattern of inter-relationships among variables in matrix fashion described by Miles and Huberman (in press).

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FINDINGS

1. School Climate

In the area of leadership, findings were divided between the two participating schools. The staff from one school believed building-level support and leadership had remained the same after the intervention. (We should note here that level of leadership was quite high.) The other school's staff believed leadership had decreased. Both of these perceptual findings were not consistent with observation of behavior. That is, there were more overt signs of leadership at both schools.

Although teachers from both schools exhibited a high pre-intervention level of collegiality and collaboration, there was a marked increase in this behavior after the intervention. Teachers began sharing ideas to a greater extent, visiting each other's classrooms, and generally behaving in a more cooperative manner.

Intervention results for expectations were inconsistent between the two participating schools. In one school teachers began incorporating behaviors which purportedly mitigate against negative expectations. Teachers from the other school (although they reported a heightened awareness of their expectations) did not exhibit clear behavioral changes.

2. Instructional Techniques

Our first analysis of instructional techniques was an examination of teachers' time use. For each category of non-instructional time, two-tailed t-tests for correlated groups were performed by grade level, comparing pre and post data. Of the 40 comparisons (eight comparisons for each of five grade levels) only ten showed significant differences ($p < .05$). Five differences occurred in the expected direction (less post-intervention non-instructional time used) and five differences

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occurred in the direction not expected (more post-intervention non-instructional time used). Closer examination of the data indicated that teachers used less time in managerial activities (beginning and ending class) and more time in explaining assignments to students. The overall amount of non-instructional time stayed about the same from pre to post data collection. However, within that time teachers changed the balance of their activity; they decreased the amount of time spent on managerial activities and increased the amount of time related to preparing students for instruction.

In contrast with the findings on teacher use of time, we found that teachers exhibited a marked increase in use of managerial techniques, increasing efficiency of instruction. Teachers became clearer in presentation of classroom rules and procedures, especially at the beginning of the year, and became more precise in presentation of goals for lessons and activities within lessons.

Also, we found a marked increase in the use of motivational techniques during and after the intervention trainings. Teachers appeared more aware of student motivation and tended to use more techniques specifically designed to increase motivation.

3. Mediating Student Outcomes

Our third analysis was of mediating outcomes by examining students' use of time. We refrained from comparing pre vs. post engagement rate data in a cohort analysis fashion; students at each grade level represented a different sample of students. The pretest data at each grade level was collected from a different sample of students than was the post-test data. The assumption underlying this arrangement of the data is that the expected effect is at the teacher

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level. That is, student engagement is a function of teacher behavior. This is an assumption of what might be called the "time on task movement" within education.

Results of ten two-tailed t-tests for uncorrelated groups (five analyses for math and five for reading) showed four of the ten comparisons significant at the .05 level; in all four cases, post engagement rates (ERs) were higher than pre. In addition, three of the remaining six comparisons reported higher post ERs. Given the high level of engagement reported in the baseline data, these findings appear to indicate an intervention effect on engagement. However, when allocated time is considered, the results are different.

In general, allocated time decreased after the intervention. This, of course, had an effect on the engaged time of students. Table 1 reports the engaged times for math and reading, pre vs. post data.

Table 1
Pre/Post Engaged Time

	Math		Reading	
	Pre	Post	Pre	Post
K	5.84	27.64	72.14	70.49
1	53.29	53.44	87.51	81.96
2	41.09	36.75	57.09	72.02
3	39.31	35.29	42.87	50.49
4	44.33	40.54	48.38	52.12

As these results indicate, decreased allocated time lowered the engagement rate increases. When ER data alone was considered, seven of ten post intervention scores were higher. When engaged time is compared, only five of ten post intervention scores are higher.

We next examined student success rates. Ten two-tailed t-tests for uncorrelated groups were computed for the pre vs. post math and reading success rate (SRs) data. (Again, five comparisons are for each grade level for math, and five comparisons for reading).

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Three of the ten comparisons were significant at the .05 level. Two differences were in the expected direction (higher post intervention SR's). In addition, five of the remaining seven comparisons showed higher post-intervention SRs. As is the case with engaged rate, success rate is a component of another construct -- academic learning time (ALT). Table 2 reports comparative pre/post ALTs in minutes.

Table 2
Pre/Post ALT

	Math		Reading	
	Pre	Post	Pre	Post
K	3.84	17.55	44.99	41.39
1	26.25	32.80	41.88	50.82
2	29.34	28.17	42.51	50.94
3	19.66	24.70	35.58	35.51
4	28.88	29.98	30.96	36.42

The trend toward higher post intervention scores appears somewhat re-established in Table 2. Seven out of ten comparisons showed higher post intervention ALTs. In effect, then, the combined allocated time, engaged rate and success rate data indicated that the participating teachers decreased the amount of time they spent teaching math and reading, but compensated for this by increasing student engagement and success.

DISCUSSION

If we arrange data from the school effectiveness variables in a matrix or "display" (Miles & Huberman, in press) it appears as though the intervention had a fairly strong effect on mediating student outcomes (Engaged Time and ALT). Table 3 reports matrix results:

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Table 3

Variables
1. Leadership and support to teachers
2. Staff collegiality
3. Staff expectations
4. Teacher use of time
5. Teacher use of managerial techniques
6. Teacher use of motivational techniques
7. Engaged time
8. ALT

	school climate variables		instructional techniques			mediating student outcomes		
	1	2	3	4	5	6	7	8
School #1	no change	pos. change	pos. change	no change	pos. change	pos. change	no change	pos. change
School #2	neg. change	pos. change	no change	no change	pos. change	pos. change	no change	pos. change

This display would indicate that the intervention did, in fact, change school and teacher behavior (although to differentiated degrees), and this aggregate change had a positive effect on student behavior. This conclusion is consistent with the majority of the school effectiveness literature. If that literature is correct, the produced effect on student ALT should cause an increase in student achievement. In this study, such a causal link was not found. To illustrate, consider the achievement percentile ranks for mathematics and reading in Table 4.

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Table 4
Pre/Post Percentile Ranks

	Math			Reading		
	Pre	Post	p	Pre	Post	p
K	76.14	38.07	.000	no data	56.83	--
1	60.57	71.27	.214	82.33	70.00	.050
2	55.67	63.25	.281	59.17	67.79	.169
3	59.60	52.33	.404	52.80	56.14	.739
4	60.87	50.23		82.40	55.30	.000

Only three of the nine pre/post comparisons (two tailed t-tests) were significant, yet all three were in the direction not expected - lower post intervention achievement scores. Of the remaining six comparisons, three were in the expected direction and three were in the

direction not expected. Six of the nine comparisons showed lower post intervention achievement scores. Although not statistically significant, those findings appear to have practical significance for the trend they reveal. More precisely, a causal link between the selected school effectiveness variables and student achievement is not supported. This is highlighted if we contrast the ALT changes pre and post with the percentile rank changes, shown in Table 5.

Table 5
ALT vs. Achievement Pre/Post Changes

	Math			Reading		
	ALT		Achievement	ALT		Achievement
K	3.84	<	17.55 : P76 > P38	44.99	>	41.39 : NO DATA
1	26.25	<	32.80 : P61 < P71	41.88	<	50.82 : P82 > P70
2	29.34	≅	28.77 : P56 < P63	42.51	<	50.94 : P60 < P68
3	19.66	<	24.70 : P60 > P52	35.58	≅	35.51 : P53 ≅ P57
4	28.88	≅	29.98 : P61 > P50	30.96	<	36.42 : P82 > P55

If the causal relationship between ALT and student achievement were strong, we would expect most of the "greater than", "less than", and "approximately equal to" signs to correspond in Table 5. Instead, there is a mismatch (e.g., ALT increased while achievement decreased) in six of the nine comparisons.

CONCLUSIONS

The findings in this study suggest some fairly important conclusions relative to the school effectiveness literature. Our findings suggest that it is possible to change school level behavior, teacher level behavior, and student level behavior by extensive inservice training. However, these changes may not have any effect on student achievement. The causal link between the school effectiveness variables and student achievement implied by past correlational studies is not supported in an experimental situation.

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The variable that generates the most surprise here is Academic Learning Time, which is a component of almost all school effectiveness models. One possible explanation for the absence of a relationship between ALT and achievement in this study is an overall reduction by interaction on each of the selected variables. For example, it might be the case that ALT interacts with staff expectations and building leadership in a particular manner. Since the effect of those variables was not strong, the effect of ALT was reduced, cancelled or even reversed. Another explanation (one we tend to favor) is that the common perception of ALT is far too simplistic a construct.

Berliner (1984) defines ALT as time engaged with materials or activities related to the outcome measure being used (often an achievement test), during which a student experiences a high success rate. The critical part of the ALT construct definition is the "relatedness of the activities/materials to the outcome measure." Commonly, this relatedness or curriculum/test congruence is operationalized by comparing the curriculum objectives with those of the standardized test. Herein lies the oversimplification of the construct. School and district curriculum guides usually report curriculum areas as very general outcome behaviors. Usually this is done in behavioral objective form (e.g., Given 10 two-part story problems the student will be able to solve 8 of 10). Given such a loose definition, any activity which is remotely related to an academic task (e.g., doing a worksheet on multiplication problems) would be considered ALT. Such a broad definition is not in keeping with current research and theory on academic tasks.

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The ability to accomplish an academic task is a function of at least two broad categories of knowledge. Anderson (1983) speaks of two basic knowledge domains: declarative and procedural. Declarative knowledge is of facts; procedural knowledge is about how to do things. Horn (1979) discusses crystallized and fluid intelligence. Crystallized, intelligence is roughly analogous to declarative knowledge; fluid intelligence is roughly analogous to procedural knowledge. Cohen and De Avila (1983) have recently argued that much of the time on task and ALT research fails to make the distinction between two types of instruction, one of which the aim is to promote knowledge of fairly low order facts, the other of which the aim is to promote understanding of how to apply knowledge and solve problems. Cohen and De Avila (1983) argue that most of the instructional models which spring from the time on task/ALT research are not conducive to reinforcing procedural or fluid knowledge.

We believe that the Cohen and De Avila assertion is a very plausible explanation for the results found in this study. Specifically, we believe that the emphasis on the part of participating teachers at systematizing their instruction and simplifying the content had the effect of increasing ALT as currently defined, but actually worked to the detriment of helping students become independent thinkers/problem solver-skills necessary for success in taking standardized tests. Those necessary higher level skills (e.g., procedural knowledge/fluid intelligence) cannot be taught using a highly structured teacher-driven model. Instead, students must be presented with situations which require them to manipulate and use information in complex ways. This, of course, changes the notion of

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construction drastically. Answers are not absolute; a certain level of ambiguity usually permeates the atmosphere; the teacher might not be the holder of authoritative knowledge in some situations. For such an environment we have few instructional models. This is perhaps what led Doyle (1983) to comment: "The central point is that the type of tasks which cognitive psychology suggests will have the greatest long-term consequences for improving the quality of academic work are precisely those which are the most difficult to install in classrooms" (p. 186).

A reexamination of the findings of this study in light of the above discussion of ALT and its translation to instruction leads us to believe that the school climate variables studied and the instructional variables do have a causal effect on the mediating student outcomes - time on task and ALT. However, the mediating student outcomes (as currently defined) do not have a strong causal relationship with student achievement as measured by standardized tests. Our recommendation is that the ALT construct be more rigorously defined, or partitioned into activities that deal with procedural knowledge and those that deal with declarative knowledge. Only when the ALT construct is more clearly understood will educators be able to make strong recommendations for instructional practices.

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